

# Mark Wayne Paris

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Theoretical Division  
Los Alamos National Laboratory  
MS B283  
Los Alamos, New Mexico 87545

T (505) 665-0455  
F (505) 667-1931  
mparis@lanl.gov  
<http://public.lanl.gov/mparis>

## Education

Ph.D. Physics, University of Illinois at Urbana-Champaign (UIUC), September 2000  
Dissertation: *Quantum Monte Carlo Calculations of Three- and Six-Quark States*  
Adviser: Vijay R. Pandharipande  
M.S. Physics, UIUC, 1994  
B.A. Physics with High Honors, Rutgers, The State University of New Jersey, 1992

## Honors

Most Valued Reviewer 2011, *Physics Letters B* (J.-P. Blaizot, Ed.)  
Visiting Scholar, Institute for Nuclear Theory, University of Washington, 11/2009  
GAANN Fellowship, Department of Physics, UIUC, 1996  
Sigma Pi Sigma, since 1991

## Grants

Co-PI, *Data Analysis Center for Electromagnetic and Hadronic Scattering Processes*  
U.S. Department of Energy Grant DE-FG02-99-ER41110

## Experience

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| 01/2012 – Present: | Staff Member, Theoretical Division, Los Alamos National Laboratory   |
| 06/2010 – 12/2011: | Assistant Research Professor, Center for Nuclear Studies,<br>Department of Physics, George Washington University |
| 08/2008 – 05/2010: | Research Scientist, Center for Nuclear Studies,<br>Department of Physics, George Washington University           |
| 11/2006 – 08/2008: | Research Scientist, Excited Baryon Analysis Center,<br>Theory Group, Jefferson Laboratory                        |
| 11/2003 – 11/2006: | Postdoctoral Fellow, Theory Group, Jefferson Laboratory  |
| 10/2001 – 10/2003: | Postdoctoral Research Assistant, Theoretical Division,<br>Los Alamos National Laboratory                         |
| 07/2001 – 10/2001: | Postdoctoral Research Assistant, University of Basel   |
| 01/2001 – 07/2001: | Postdoctoral Research Assistant, UIUC  |
| 1995 – 2001:       | Graduate Research Assistant, UIUC  |
| 1993 – 1997:       | Graduate Teaching Assistant, UIUC  |

## Research Interests

Nuclear and subnuclear structure and reactions  
Dynamical coupled channel reaction theory  
Parity violation in nucleon-nucleon interaction  
Many-body techniques  
Analytic S-matrix theory  
Hadronic resonance theory and phenomenology  
Computational physics  
Quantum Monte Carlo methods  
Effective theories of QCD applied to nuclear physics  
Electron scattering from nuclear and hadronic systems  
Exotic QCD phases in dense matter  
Compact star structure

## Publications

- ( 1) R-matrix analysis of reactions in the 9B compound system  
arXiv:1304.3153, *submitted to Nucl. Data Sh.* (with G. Hale, A. Hayes, and G. Jungman)
- ( 2) Parametrization dependence of  $T$  matrix poles and eigenphases from a fit to  $\pi N$  elastic scattering data  
Phys. Rev. C, **86**, 035202 (2012) (with R. Workman, R. Arndt, W. Briscoe, and I. Strakovsky)
- ( 3) Amplitude analysis of  $\gamma n \rightarrow \pi^- p$  data above 1 GeV  
Phys. Rev. C, **86**, 015206 (2012) (with W. Chen, H. Gao, *et. al.*)
- ( 4) Unified Chew-Mandelstam SAID analysis of pion photoproduction data  
Phys. Rev. C, **86**, *Editor's suggestion*, 015202 (2012)  
(with R. Workman, R. Arndt, W. Briscoe, and I. Strakovsky)
- ( 5) Functional reduction of the  $S$  matrix in the canonical formalism  
arXiv:1108.3164, *in preparation*
- ( 6) Updated SAID analysis of pion photoproduction data  
Phys. Rev. C, **85**, 025201 (2012) (with R. Workman, W. Briscoe, and I. Strakovsky)
- ( 7) Model dependence of single-energy fits to pion photoproduction data  
Eur. Phys. J. A **47**, 143 (2011)  
(with R. Workman, W. Briscoe, L. Tiator, S. Schumann, M. Ostrick, and S. Kamalov)
- ( 8) Toward a unified determination of hadro- and photo-production amplitudes: the  $S$ -wave multipole for eta photoproduction  
Phys. Rev. C, **82**, 035202 (2010) (with R. Workman)
- ( 9) Study of the  $\gamma p \rightarrow \eta p$  reaction with the Crystal Ball detector at the Mainz Microtron (MAMI-C)  
Phys. Rev. C, **82**, 035208 (2010) (with Crystall Ball Collaboration)
- (10) Partial wave analysis of the reaction  $\gamma p \rightarrow \omega p$  and the search for nucleon resonances  
Phys. Rev. C, **80**, 065209 (2009) (with M. Williams and the CLAS Collaboration)
- (11) Differential cross sections and spin density matrix elements for the reaction  $\gamma p \rightarrow \omega p$   
Phys. Rev. C, **80**, 065208 (2009) (with M. Williams and the CLAS Collaboration)
- (12) Photoproduction of  $\pi^+ \pi^-$  meson pairs on the proton  
Phys. Rev. D, **80**, 072005 (2009)(with the CLAS Collaboration)
- (13) Measurement of direct  $f_0(980)$  photoproduction on the proton  
Phys. Rev. Lett. **102**, 102001 (2009)(with the CLAS Collaboration)
- (14) Resonance parameters from  $K$ -matrix and  $T$ -matrix poles  
Phys. Rev. C, **79**, 038201 (2009) (with R. Workman and R. Arndt)
- (15) Dynamical coupled channel theory of pion and omega meson production  
Phys. Rev. C, **79**, 025208 (2009)
- (16) Variational Monte Carlo study of pentaquark states  
Phys. Rev. Lett., **95**, 202002 (2005)
- (17) Hybrid stars that masquerade as neutron stars  
Astrophys. J. **629**, 969-978 (2005) (with M. Alford, M. Braby, and S. Reddy)
- (18) Virtual photon asymmetry for confined, interacting Dirac particles with spin symmetry  
Phys. Rev. C, **71**, *Rapid Communications*, 022201 (2005) (with V. Pandharipande and I. Sick)
- (19) Parity-violating interaction effects in the  $np$  system  
Phys. Rev. C, **70**, 044007 (2004) (with J. Carlson and R. Schiavilla)
- (20) Electromagnetic response of a confined Dirac particle  
Phys. Rev. C, **68**, 025201 (2003)
- (21) Parity violating interactions and and currents in the deuteron  
Phys. Rev. C, **67**, 032501 (2003) (with J. Carlson and R. Schiavilla)
- (22) Final state interaction contribution of confined relativistic particles  
Phys. Rev. C, **65**, 035203 (2002) (with V. Pandharipande)
- (23) Scaling of space and timelike response of confined relativistic particles  
Phys. Lett. B, **514**, 361-365 (2001) (with V. Pandharipande)
- (24) Quantum Monte Carlo calculations of six-quark states  
Phys. Rev. C, **62**, 015201 (2000) (with V. Pandharipande)

## Teaching

Instructor, Graduate *Communication in Physics*

The George Washington University, Fall 2010 – Spring 2011

Research adviser, Honors Research/Mentorship Program

Authored, *Quantum Mechanics and the Quark Model: An Introductory Course*

Thomas Jefferson National Accelerator Facility, 09/2005–05/2008

Guest lecturer, Graduate *Quantum Mechanics I*

The University of Illinois at Urbana-Champaign, 01/2001–07/2001

Grader, Graduate *Statistical Mechanics*

The University of Illinois at Urbana-Champaign, 09/1996–12/1996

Teaching assistant, Undergraduate *College and University Physics*

The University of Illinois at Urbana-Champaign, 09/1993–05/1996

## Advising

Graduate thesis adviser, Berhan Demissie

*Theory and phenomenology of Compton scattering in the resonance region*

## Invited Talks

- (1) Unified description of hadro- and photo-production amplitudes  
Invited talk at the Workshop on Amplitude Analysis in Hadron Spectroscopy  
European Centre for Theoretical Studies in Nuclear Physics, January 24–28, 2011, Trento, Italy
- (2) Baryonic spectra from multichannel amplitudes  
Invited talk at the 2010 Fall Meeting of the APS Division of Nuclear Physics  
November 2–6, 2010, Santa Fe, New Mexico
- (3) Dynamical coupled channel calculation of pion and omega photoproduction  
Invited talk at the Jefferson Lab-INT Workshop on Hadron Spectroscopy, November 9–13, 2009
- (4) The SAID amplitudes: partial wave reconstruction from observables  
Invited talk at the Jefferson Lab-INT Workshop on Hadron Spectroscopy, November 9–13, 2009
- (5) Spin asymmetries for confined Dirac particles  
Invited talk at Electron-Nucleus Scattering, Elba, Italy 2004  
(with V. Pandharipande and I. Sick)  
Eur. Phys. J. A, **24S1**, 143-147 (2005)
- (6) Spacelike and timelike response of confined relativistic particles  
Invited talk at Electron-Nucleus Scattering, Elba, Italy 2002  
Eur. Phys. J. A, **17**, 401-405 (2003)

## Conference Proceedings

- Progress on neutron-target multipoles above 1 GeV  
(with I. Strakovsky, W. Briscoe, D. Dutta, W. Chen *et. al.*)  
12th International Workshop on Meson Production, Properties and Interaction (MESON2012),  
31 May - 5 June 2012, Krakow, Poland
- Measurement of the  $\gamma p \rightarrow \eta p$  reaction with the Crystal Ball detector at the Mainz Microtron (MAMI-C)  
AIP Conf. Proc. 1374, 439-442 (2011)
- Effect of  $\Sigma$ -beam Asymmetry Data on Fits to Single Pion Photoproduction off Neutron  
AIP Conf. Proc. 1432, 383-386 (2012)
- The recent absolute total  $np$  and  $pp$  cross section determinations: quality of data description  
and prediction of experimental observables  
(with A. Laptev, R. Haight, R. Arndt, W. Briscoe, I. Strakovsky, R. Workman)  
Proceedings of the International Conference on Nuclear Data  
for Science and Technology, Jeju Island, Korea 26-30 April, 2010
- Toward a unified description of hadro- and photoproduction amplitudes  
(with R. Arndt, R. Workman, W. Briscoe, and I. Strakovsky)  
Proceedings of the 12th International Conference on Meson-Nucleon Physics  
and the Structure of the Nucleon (MENU 2010), Williamsburg, Virginia, 31 May - 4 Jun 2010
- Baryon resonance analysis from SAID  
(with I. Strakovsky, R. Arndt, W. Briscoe, R. Workman)  
Workshop on the Physics of Excited Nucleon: NSTAR 2009, Beijing, China, 19-22 Apr 2009  
Chinese Physics C, **33**(12), 1063-1068 (2009)
- Dynamical coupled channel approach to omega meson production  
The 11th International Conference on Meson-Nucleon Physics (MENU 2007), Julich, Germany, 10-14 Sep 2007  
*In the Proceedings of 11th International Conference on Meson-Nucleon Physics, pp 274*
- Variational Monte Carlo study of pentaquark states in a correlated quark model  
Particles and Nuclei International Conference (PANIC 05), Santa Fe, New Mexico, 24-28 Oct 2005  
AIP Conf. Proc. **842**, 471-473 (2006)
- Parity violation in few-nucleon systems  
(with J. Carlson)  
The 8th Workshop on Electron Nucleus Scattering, Elba, Italy, 21-25 Jun 2004  
Eur. Phys. J. A **24S1**, 123-125 (2005)
- Parity violating effects in two-nucleon systems  
(with J. Carlson and R. Schiavilla)  
CFIF Fall Workshop 2002: Nuclear Dynamics, Lisbon, Portugal, 31 Oct-2 Nov 2002  
Few Body Syst. Suppl. **15**, 13-23 (2003)

## Other Professional Activities

- Founding member *Light Hadron Spectrum Collaboration*  
Limited member of the CLAS Collaboration  
Member bi-annual Jefferson Lab Technical Advisory Committee, 2003-2008  
Referee: Phys. Rev. C, Mod. Phys. Lett. A  
Mentor in New Horizons Governor's School, Hampton, Virginia, 2004 – 2008  
Invited lecturer at Hampton University Graduate School June, 2004  
Tutor at Santa Clara Pueblo, Española, New Mexico, 10/02 – 10/04